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RESPONSE TO BTAG COMMENTS FOR THE DRAFT ROUND TWO REMEDIAL INVESTIGATION REPORT, SITES 4, 21, AND 22, NAVAL WEAPONS YORKTOWN, YORKTOWN, VIRGINIA

On page 7-1, the statement is made that "...benthic macroinvertebrates were not evaluated in this ecological RA" because they were "...not expected to be a good predictor of impacts resulting from contamination." However, the first assessment endpoint is the "protection of benthic invertebrate communities from contamination...." The author needs to more clearly indicate why this piece of benthic community evidence was not evaluated to see if it would be helpful in a weight of evidence approach.

Response: Benthic macroinvertebrate samples were collected from Felgates Creek at Sites 4 and 21. These samples were not evaluated in the Round Two RI because this is a screening-level RA, but were archived for future analysis.

On page 7-1, the statement is made that round one data was not used in this round two ecological risk assessment. This section needs to clearly indicate why these data were not used. The two data sets should be analyzed statistically to see if they are similar and therefore can be combined.

Response: Round One data was not used in the ecological risk assessment because a removal action occurred at the sites after the Round one investigation. The removal is expected to have impacted contaminant concentrations at the sites. As stated in the comments "the purpose of this investigation is to ... assess potential human health and ecological risk associated with contamination remaining at the sites following the removal actions"; therefore, it is not appropriate to use data from the Round One Investigations in the Round Two ecological risk assessment.

There are a number of important appendices and tables that were not contained in the document received for review. Appendix K contains the ecological screening levels used in the ERA. Appendix L contains mean and maximum concentrations used in this ERA to determine potential impacts to ecological receptors. Also, Tables 7-1 through 7-24, 7-26 through 7-30, 7-32 through 7-49, and 7-51 through 7-61 are missing from the document reviewed.

Response: Only sections, tables or appendices that required changes were submitted as part the Draft Final report. The missing appendices and tables were not changed from the Draft to the Draft Final version therefore, the original appendices and tables from the draft version should be used.

On page 7-7, under the heading Groundwater, the statement is made that "...groundwater data were not used to determine risks to ecological receptors." However, this section goes on to identify 7 pesticides, 4 nitramine compounds, and 9 inorganics as ECOCs (ecological contaminants of concern) at Site 4. This section needs to more clearly indicate what the

identification of these ECOCs means. On page 7-5, the statement is made that groundwater contaminant data is not used to determine risks to ecological receptors because they are not in direct contact with this medium. Additional statements about the potential pathways from groundwater to surface waters, and thereby ecological receptors need to be included. This comment also applies to Sites 21 and 22.

Response: The text has been modified to clarify that groundwater data are screened against BTAG benchmarks for tidal surface water to evaluate potential risks to future aquatic receptors. Discussions regarding potential pathways from groundwater to surface waters and exposure to terrestrial receptors are also provided in the text.

On page 7-11, the exposure pathways evaluated in this ERA included: ingestion of water, soil, sediment, vegetation, and/or the ingestion of small mammals. The author does not include aquatic organisms as an exposure pathway. This omission needs to be explained.

Response: The ingestion of fish is evaluated in the great blue heron and mink receptor models. This has been noted in the text.

On page 7-12, the assessment endpoints are listed in section 7.1.4. These assessment endpoints appear broad and non-specific. Considering this was a screening level ERA and relatively limited data were available, the listed assessment endpoints appear ambitious. For example, the benthic invertebrate assessment endpoint is listed as:

> Protection of benthic invertebrate communities from the toxic effects of contaminants in sediment to maintain species diversity, biomass, and nutrient cycling (trophic structure); to provide a food source for higher level consumers; and to insure those contaminant levels in benthic invertebrate tissues are low enough to minimize the risk of bioaccumulation and/or other negative toxic effects in higher trophic levels.

Protection of species diversity and biomass (abundance) would have been sufficient. The remainder of the assessment endpoints listed for benthic invertebrates are not specific to the invertebrate community and do not assess benthic invertebrate community health, but address possible risks to higher trophic levels that may prey upon benthic organisms. These additional assessment endpoints should be discarded. A similar assessment endpoint was also listed for the fish and amphibian communities which addressed protection of higher trophic levels. As with the benthic invertebrates, these assessment endpoints should not be included.

Response: The text regarding assessment endpoints has been modified as recommended.

Piscivorous mammal is not included as an assessment/measurement endpoint. This omission needs to be explained.

Response: The mink has been added to the ecological receptors to evaluate potential risks to piscivorous mammals.

On page 7-13, assessment endpoint number 13 is about the protection of vegetation, but appears to be including only terrestrial vegetation because of the reference to soil contamination. The author needs to include aquatic/emergent vegetation too.

Response: Aquatic/emergent vegetation has been added as an assessment endpoint.

On page 7-14, section 7.1.5 lists 7 hypotheses. While these hypotheses appear to be specific (i.e. "Are the levels of site contaminants in sediment sufficient to cause adverse alterations to the structure and function of the benthic community...?"), these hypotheses do not appear to be specifically answered in the ERA or chapter 8 (Results and Conclusions).

Response: The text has been modified to specifically answer the hypothesis in the Ecological Risk Assessment Summary portion of Section 7.

On page 7-15, section 7.1.6 contains measurement endpoints. These measurement endpoints appear non-specific and vague. For example, the fish community measurement endpoint is listed as:

> Ecological health of the fish communities that inhabit waterbodies potentially impacted by Sites 4, 21, and 22. The selected measurement endpoint receptor species is the largemouth bass. Contaminant concentrations measured in the surface water and sediment were compared to concentrations documented to cause adverse impacts to fish.

The measurement endpoint may be implied in this statement, but it is never clearly defined. A specific adverse effect should have been stated, such as reproductive impact, and data from the literature reporting on concentrations of the COC in water, sediments, or tissues that result in reproductive impairment in bass should have been used to assess whether conditions at the site pose a risk to this species.

Response: The text has been modified to clearly define measurement endpoints. Where data regarding potential impacts of ECOCs to fish were available, they were used to assess whether conditions at the site pose a potential risk to the largemouth bass receptor.

Under Section 7.2, page 7-20, a number of assumptions are listed. One of these states that a biota-to-soil/sediment accumulation factor of one was assumed for vegetation, invertebrates, fish, and small mammals. However, in assessing the toxicity of sediments to the benthic community, the author states in the discussion of measurement endpoints that impacts to the benthic community would be assessed through comparison of sediment contaminant concentrations to appropriate literature toxicity benchmark values. The assumption implies that tissue concentrations of contaminants would be used to assess impacts to benthic invertebrates and other aquatic receptors. If the stated assumption was used to indicate tissue concentrations for the purpose of food web effects, then this needs to be clearly stated. The assumption is made, but it is not clear how it is carried through the risk assessment.

Response: The text has been modified to clarify that potential risks to the benthic community are evaluated by comparing sediment concentrations to BTAG sediment screening values. In food chain transfer models for upper trophic levels receptors, contaminant concentrations in *food sources* are estimated by using transfer factors for soil to invertebrates, soil to plants, soil to small mammals, etc. as appropriate. No transfer factors are available to estimate contaminant transfer from sediment or surface water to benthic invertebrates, aquatic flora, or aquatic vertebrates; therefore, a transfer factor of 1.0 is assumed.

On page 7-20, the second bullet under Assumptions (section 7.2) says that "...a biota to soil/water/sediment accumulation factor (BSAF) of 1 was assumed for the vegetation, invertebrates, fish, and small mammals." While this was the BTAG position in 1997, the current BTAG position (2000) is to use more realistic BSAFs when they are supported by the literature and to use a BSAF of 1 only when a more realistic value does not exist.

Response: Updated BSAFs available from the literature have been incorporated into the risk assessment. When data were not available, a default BSAF of 1.0 was assumed.

On page 7-21, the first bullet indicates that because "...no data were located on fish consumption of surface water and sediment...these pathways were not assessed in largemouth bass receptor model." There are a number ways to fill this data gap. One way would be to utilize fish tissue concentrations and relate these to effects information. Another way is to make reasonable assumptions about the amount of water and sediment ingested by this receptor and to include this in the model. Both of these methods would have to be included in the uncertainty section discussion also. Finally, the most important surface water to fish pathway may involve the gills and skin and not ingestion.

Response: Fish consumption of sediment was conservatively estimated at 10% and was incorporated into the receptor models. Because the majority of fish and amphibian exposure to contaminants in water likely occurs dermally rather than via ingestion, water ingestion was not incorporated into the largemouth bass or bullfrog receptor models. Dermal exposure was not directly evaluated; however, screening values for freshwater, protective of aquatic flora and fauna, were evaluated and discussed in the text. Estimates of exposure parameters, dermal, and oral exposure pathways are addressed in the uncertainty section of Section 7.

In a previous version of this document, the body weight used for the largemouth bass in calculating dose was 0.6 kg (1.1 pounds). Because only portions of Volume 1 were available for review, discussions with USFWS indicate that the largemouth bass body weight used was 1.1 kg (Appendix L.5). This represents a reasonably large bass that is primarily, if not entirely, piscivorous. If it is to be assumed that such a fish is going feed entirely on benthic invertebrates, then such an assumption is untenable. Although an ERA should use conservative assumptions when there is little data, it is also necessary that such assumptions be clearly stated and based on fact. In Appendix L.5 the same body weight and ingestion rate for the largemouth bass is used for both the conservative and less conservative scenarios. The author needs to clearly indicate the reasons for using the same values in these two different scenarios.

Response: Body weights for the largemouth bass were researched and conservative and less conservative exposure parameters were determined based upon available data and best professional judgement. The estimated dietary intake for the largemouth bass was 50% fish and 50% benthic invertebrates. Estimated contaminant concentrations in both of these food sources are modeled from sediment concentrations with a transfer factor of one for all compounds due to the lack of available data regarding sediment to benthic invertebrate and sediment to fish bioaccumulation factors.

On page 7-21, the first bullet indicates that because "...no data were located on frog consumption of water...this pathway was not assessed in the bullfrog model." Again, alternative methods (see previous comment on fish) could be used with reasonable assumptions or tissue data to assist in filling this data gap.

Response: See response to previous comment on fish.

On page 7-21, the second bullet identifies how toxicity benchmark values are determined for the ECOCs when ingested by receptor species. If no toxicity benchmark value was available for the selected species, then one from a closely related species was used. This process needs to be more fully explained. For example, how close is "closely related" defined? Were any safety factors utilized?

Response: The text has been modified to clearly explain the selection of ecotoxicity screening values.

On this same page, in the same bullet, the statement is made "When values for chronic toxicity were not available, median lethal dose (LD_{50}) values were used. A factor of 100 was used to convert reported LD_{50}s to NOAELs." Since the LD_{50} is the dose that kills 50% of the test organisms, this is too extreme to be considered a chronic dose. At a minimum, a safety factor of 10 needs to be applied to and LD_{50} to convert it to an LD_{20}. Then the safety factor of 100 can be applied to the LD_{20} to convert it to a NOAEL.

Response: All ecotoxicity values have been checked and recalculated as appropriate. A clear explanation of methods used has been added to the text.

On page 7-22, the statement is made in section 7.3 (exposure profile) that "Receptor species were selected based on two primary requirements: 1) the species potentially may inhabit Sites 4, 21, and 22) the species represent various trophic levels in the food chain." This statement should be changed to: "Receptor...Sites 4, 21, and 22; and 2)...chain."

Response: The statement has been revised.

On page 7-25, the first sentence in section 7.4 (effects profile) should be changed to: "Contaminants that exceed screening levels are assumed to be adversely impacting receptor species, populations, and communities in the aquatic and terrestrial ecosystems at Sites 4, 21, and 22."

Response: The statement has been revised.

On page 7-25, the hazard quotient formula should be changed to: Hazard Quotient = Exposure Concentration/Screening Value. The fact that the exposure concentration can be either the maximum or the mean value and that the screening values are listed in a particular table can be explained in the text.

Response: The formula has been changed as recommended. The text has been modified to clarify distinctions between conservative and less conservative exposure scenarios.

On page 7-26, the first two sentences of the first full paragraph should be changed to: "An HQ equal to or greater than one indicates that exposure to the contaminant has the potential to cause adverse effects to the species. An HQ less than one indicates that the contaminant is not expected to cause adverse effects to the species, but may be re-evaluated based on the magnitude of the HQ and the bioaccumulative nature of the contaminant."

Response: The text has been revised as recommended.

On page 7-26, section 7.6.2 (use of background concentrations) indicates that "Consideration was taken in the selection of background areas to select areas that appeared to be relatively unimpacted by surrounding land use." This statement should be changed to "Consideration was taken in selecting background sampling locations to ensure these background areas contained similar habitats as Sites 4, 21, and 22 and were not impacted by contaminants."

Response: The text has been revised as recommended.

On page 7-27, in the last line, the acronym SSLs is used without being defined. The previous sentence references sediment screening levels. Does sediment screening levels equal SSLs? This needs to be made clear in the text. There are a number of other acronyms (SWSLs and SSSLs (see page 7-28) which are also not defined in the text.

Response: The text has been checked to ensure that all acronyms are defined in the text.

On page 7-28, starting on line 4, the statement is made that SSLs were developed using data obtained from freshwater, tidal freshwater, and marine environments. The next sentence indicates uncertainty in using these SSLs "...to evaluate potential effects to aquatic organisms from contaminants in freshwater habitats...." The author is not clear as to why SSLs developed from freshwater could not be used to evaluate effects from contaminants in freshwater habitats.

Response: The text has been modified to more clearly address the appropriateness of using sediment screening levels developed from a variety of habitats to evaluate potential risks is the freshwater and tidal freshwater habitats at the sites.

On page 7-30, section 7.7 (results) indicates "Exceedances of appropriate background UCLs are presented for the constituents that present a potential risk to ecological receptors at the

site." The author is not clear as to why these background UCLs are being incorporated into the ecological risk assessment. This is traditionally viewed as part of risk management and not risk assessment.

Response: The text has been modified to clarify that background data is provided for comparative purposes only to aid in risk management decisions and has not been incorporated into risk calculations or in decisions regarding ECOC selection.

On page 7-36, under the Aquatic Receptor Models section chromium was listed as having an HQ of greater than 1 for both the most and least conservative receptor models. Yet, chromium was not considered an ECOC in sediment (due to a comparison with background UCL), but was considered an ECOC in surface water. Under the more traditional ecological risk assessment methodology, chromium would be retained as a sediment ECOC (because comparison with background concentrations is a risk management, not risk assessment, technique).

Response: The text has been modified to clarify that background data was not considered during the selection of ECOCs.

On page 7-36, section 7.7.3.2 (tidal freshwater habitat) indicates that surface water concentrations were not screened against any benchmark, yet ECOC were identified. Without screening, identifying an ECOC list would be fairly difficult. The author needs to clearly discuss how this ECOC list was established. This explanation should identify why the ambient water quality criteria were not used.

Response: The text has been modified to clearly identify the process used to select ECOCs. The use of Ambient Water Quality Criteria as secondary sources of screening levels for surface water is discussed in Appendix K.2.

On page 7-39, in section 7.7.5 (Site 22 - Aquatic Assessment), the statement is made that "Maximum concentrations of the ECOCs detected in the sediment collected at Site 22 were compared with available benchmark values." This statement is confusing. The author is not clear on how the ECOCs were determined before comparing to benchmark (screening) values.

Response: The text has been modified to clarify the selection of ECOCs in sediment.

On page 7-41, section 7.8.1.2 (Site 4 proper), the statement is made that inorganics were detected at higher concentrations during round two RI than during round one RI. This statement appears to be in opposition to one that appears on page 7-1 which states, "The Round One data was not used in this ecological RA." The author needs to more clearly discuss the use of these round one data. This same comment also applies to sections 7.8.2 (Site 21 - Terrestrial Environment), section 7.8.3 (Sites 4 and 21 - Aquatic Environment), and section 7.8.4 (Site 22 - Terrestrial Environment).

Response: The text has been modified to clarify that only data from the Round Two RI was used in the ecological risk assessment.

On page 7-43, section 7.8.3.2 (Tidal Freshwater Habitat), the statement is made that "Surface water concentrations of aluminum...were detected below background UCLs and.aluminum concentrations were above background UCLs." This "above" and "below" discrepancy needs to be corrected.

Response: The text has been modified as necessary.

On page 7-43, section 7.8.4 (Site 22 - Terrestrial Environment) contains a reference to "...two adjacent samples within the marsh area...." The author needs to clarify if these marsh sample locations and data need to be deleted from this terrestrial environment section and placed in the Site 22 - Aquatic Environment section (7.8.5).

Response: The text has been modified to ensure that the aquatic and terrestrial environments at Site 22 are addressed appropriately.

On page 7-44, section 7.8.5 indicates that iron, manganese, selenium, and thallium exceeded benchmark values. However, section 7.8.4 shows aluminum, antimony, chromium, and copper at high levels. The apparent inconsistencies between the ECOCs reported for the same medium between these two sections need to be corrected.

Response: The inconsistencies in the text have been amended.

On page 8-6, under Tidal Freshwater Habitat, the statement is made, "...sediment concentrations of aluminum produced in modeled aquatic receptors." Should this statement read, "...sediment concentrations of aluminum produced **potential risk** in modeled aquatic receptors?"

Response: The text has been modified as recommended.

Chapter 8 (Results and Conclusions) indicates that ECOC concentrations were compared to background ranges. Because this is a screening level ERA, these risk management comparisons should be to the lower end of the background range and not the maximum background concentration. Some of the ranges presented in the tables are quite large and may suggest the need for additional/alternative background samples.

Response: The text has been modified to clarify that background concentrations were not used to evaluate potential risk, but to aid in risk management decisions. The range of background concentrations is provided rather than the Upper 95% UCL.

According to the document (Section 2.2.3.3, page 2-17), biota samples were collected as part of the Round Two RI, however, no information was presented in the ERA describing the types of biological samples collected, what the biological samples were collected for, or the results of biological data analyses. It is not known if these data were inadvertently omitted from the draft Round Two RI or were not available for inclusion in the draft document.

Response: The text has been modified to clarify that biota samples were collected but were not used in the ecological risk assessment based on decisions made in partnering.

An additional concern is that no dioxin analyses were conducted on samples from Site 22 (Burn Pad). The fact that spent solvents and explosives were incinerated in the open at Site 22 raises the question as to whether dioxins could have been produced and deposited in surrounding soils. Soil samples from areas around Site 22 need to be analyzed for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Contingent upon the results of the soil analyses, sediments from Felgates Creek may also need to be analyzed for PCDDs/PCDFs.

Response: Currently the Navy is selecting locations to sample surface soil at Sites 4, 21, and 22 to determine if dioxins (mainly 2,3,7,8-TCDD) are a problem. The sample locations will be selected based on the predominent wind direction. Contingent upon the results of the soil analyses, additional sampling will be determined.